

# A High Energy and High Efficiency Spectral Shaping Single Frequency Fiber Laser, Phase I

Completed Technology Project (2007 - 2007)



## Project Introduction

This SBIR phase I project proposes a tunable single frequency high energy fiber laser system for coherent Lidar systems for remote sensing. Current state-of-art technologies can not provide all features of high energy and efficiency, compactness, narrow linewidth, super frequency and power stability, low noise, and high extinction ratio at the same time. PolarOnyx proposes, for the first time, a fast tuning (sub-microsecond) high energy (100 mJ) single frequency ( $< 1$  KHz) fiber laser transmitter to meet with the requirement of solicitation. It is a specialty fiber based MOPA operating at 1550 nm. The mode selection in seed fiber laser is achieved by using an EO polymer based ultra narrow bandpass tunable filter. The output power can be scalable to several hundreds mW without any spatial hole burning issues and the frequency can be controlled at a stable and accurate operation. In the amplifier stage, PolarOnyx proposes a revolutionary approach to fundamentally resolve the issues of nonlinear effects by employing our patent pending proprietary technologies in fiber lasers. Our unique spectral shaping techniques enable us to reduce the SBS and ASE noise significantly in the amplifier for commercially available EYDFs and to reuse the residual pump to further increase the efficiency. These will make the fiber laser transmitter system superior in terms of wall plug efficiency (over 30%), energy(100 mJ), noise, size, and cost. A tabletop experiment will be demonstrated in Phase I time frame for proof of concept. A compact prototype will be delivered in Phase II.

## Anticipated Benefits

There are a number of potential applications for the proposed high power fiber laser transmitter system: Medical equipment and biomedical instrumentation. The high power laser can be applied to ophthalmology, refractive surgery, photocoagulation, general surgery, therapeutic, imaging, and cosmetic applications. Biomedical instruments include those involved in cells or proteins, cytometry, and DNA sequencing; laser Raman spectroscopy, spectrofluorimetry, and ablation; and laser based microscopes. Military / aerospace. The proposed fiber laser can be directly used in military applications, and space, aircraft, and satellite applications such as LIDAR systems, remote sensing system, illuminator system, and phase array antenna system. Optical fiber communications. Tunable lasers represent the next generation of critical optical components needed to build the local optical networks of the future and cable TVs that will deliver increased communication bandwidth and improved Quality of Service (QoS) to local access users. The market for the application is growing and will be of great potential. RHK reported the tunable lasers will have a market potential of 800 millions dollars in 2006 as a result of applications of local optical networks and cable TVs. With successful development of the fiber lasers, the technology proposed by PolarOnyx will provide a vital tool to solve the existing and potential issues and merge with the huge market of optical fiber communications. Immediate



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Langley Research Center (LaRC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

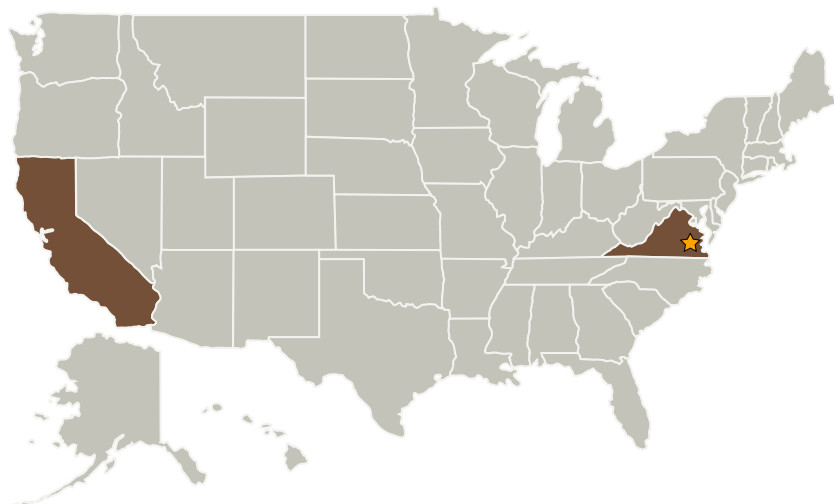
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applications include coherent lidars applications for atmospheric parameters measurement.

## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Polaronyx, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	San Jose, California

## Primary U.S. Work Locations

California	Virginia
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## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Project Manager:

Farzin Amzajerian

### Principal Investigator:

Jian Liu

## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
  - └ TX08.1.5 Lasers